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PHARMACOGNOSTICAL STUDIES ON PRIYAL: FRUITS AND SEEDS OF *BUCHANANIA LANZAN* SPRENG. (FAMILY: ANACARDIACEAE)

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ABSTRACT

'Priyal' is commonly known as 'Chironji' or 'Charoli' and is ascribed to the plant species *Buchanania lanzan* Spreng., family Anacardiaceae. In the present investigation, pharmacognostical characters of the fruit and seed of the *Buchanania lanzan* Spreng. and the commercial samples of 'Chironji' have been described which will enable to evaluate the potentiality of the drug.

'Priyal', one of the reputed drugs of the indigenous systems of medicine is largely used in the Ayurvedic and Unani systems as tonic, cardiotonic and astringent and is also employed in skin diseases. It is used in the Ayurvedic profession from early times and its mention has been made by Kalidasa in *Kumarsambhava* III: 31 (Sabnis, 1966).

The seeds are very tasteful, wholesome, nutritive and yield on expression a bland fixed oil, the physical, chemical and medicinal properties of which are similar to those of the Cashew nut oil (Khan, 1891). The oil extracted from the kernels of the fruit is used as a substitute for almond oil in native medicinal preparations (Kirtikar and Basu, 1933). The seeds are sweet, cardiotonic, astringent to the bowels, expectorant, aphrodisiac, stomachic, cure biliousness and are useful in gleet and urinary concretions (Kirtikar and Basu, 1933 ; Singh, 1949). Chopra *et al.* (1969) have reported that the seeds are also used in amoebic dysentery.

Kernels pounded into an ointment are applied to skin diseases to cure itch to remove spots and blemishes from the face. The oil extracted from the kernel is applied to glandular swellings of the neck (Biswas and Ghosh, 1951 ; Rama Rao, 1914).

Priyal is ascribed to the plant species *Buchanania lanzan* Spreng. (= *B. latifolia* Roxb.) belonging to the family Anacardiaceae. *Buchanania axillaris* (Desr.) Raman (=*B. angustifolia* Roxb.) is also being used as 'Priyal' in some parts of the country and its seeds are sold in the market under the same name. The nuts are said to be superior to those of *B. lanzan* and are used as a substitute for almonds (Bor, 1953).

Since no pharmacognostical work has been reported on *Buchanania lanzan* so far, a comprehensive investigation has been undertaken. The present communication deals with the study of fruit and seeds of this species alongwith a comparison with the commercial samples of the drug.

MATERIALS AND METHODS

Herbarium specimens of the fruiting twigs of *Buchanania lanzan* Spreng. were collected from Mohand (Saharanpur district), Gujarat, Madhya Pradesh and also obtained from the Survey of Medicinal Plants Unit, Central Council for Research in Indian Medicine and Homoeopathy, Patna and their identity was confirmed. Macro- and

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microscopical characters of the fruits and seeds were studied. Micro-chemical tests of the cell contents were performed following the techniques described by Johansen (1940), Kay (1938) and Trease (1961). Measurement of the various tissues of the fruit and seed were recorded (Table-1). The macro- and microscopical examination of the powdered fruit and seed were done and behaviour of the seed powder on treatment with different chemical reagents were observed (Table-2). Fluorescence characters of the powdered drug were observed under u-v light (Table-3) according to the method described by Chase and Pratt (1949) and Kokoski *et al.* (1958). Physico-chemical studies of the kernel oil of the genuine and market samples were carried out under the identical conditions according to the method described by Paech and Tracey (1955) (Table 4). Microscopical characters of the commercial samples procured from different places were observed and compared with the genuine sample.

Macroscopical characters (Plate I, Figs. A-D):

Fruit: Fruit a drupe, globose, 8-12 mm long with a small quantity of fleshy red sarcocarp, black when ripe, two valved, one celled, one seeded, endocarp hard, bony, laterally compressed especially near the apex, splitting vertically into two pieces during germination.

Seed: Seeds transversely oblong, much compressed laterally, especially near the top and conforming to the interior of the endocarp and covered with a thin testa. Testa brown, marked on both sides by the branching chalaza, where the seed is discoloured; funicle stout, lying in an indentation round one of the seed; micropyle superior. At the apex of the rounded edge is the linear hilum. Slight pressure separates the oily cotyledon which have a very agreeable nutty flavour. The kernel is pale yellow and consists of two large plano-convex cotyledons. Endosperm none. Embryo large, curved transverse to the axis, pale greenish yellow or almost colourless, fleshy.

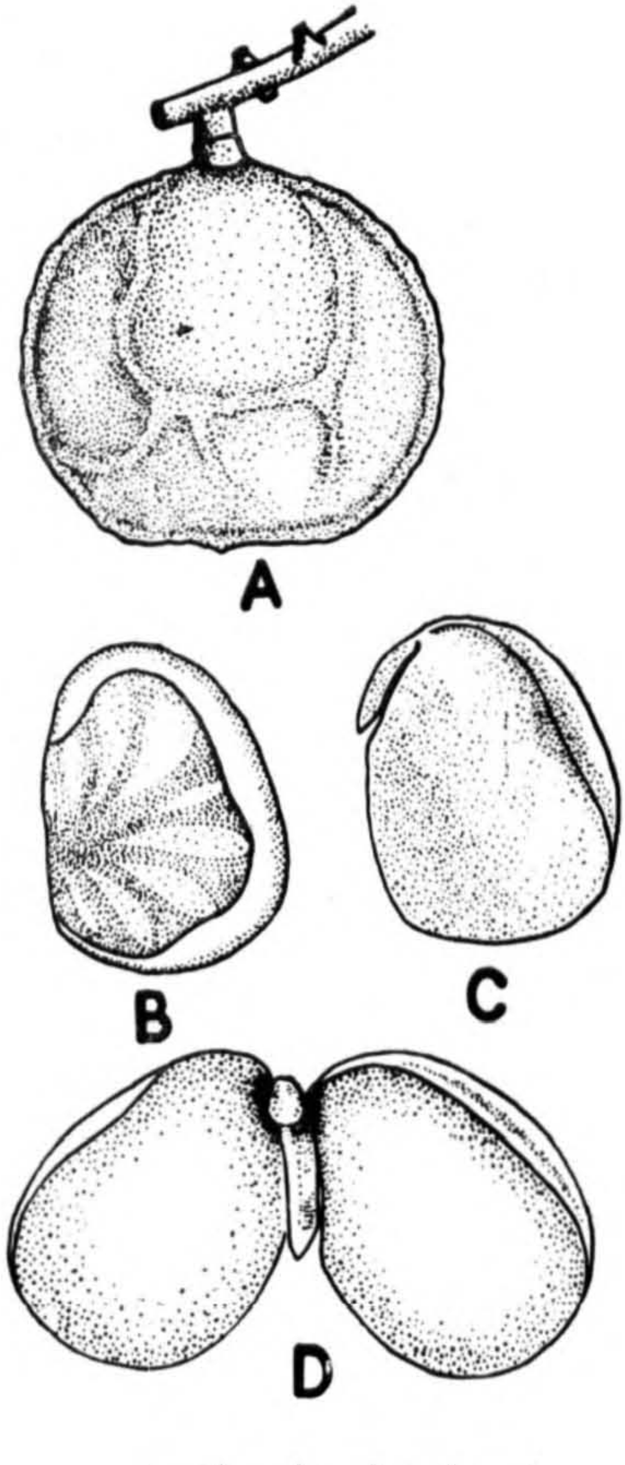

Plate I : Fruit and seed of *Buchanania lanzan* Spreng. showing macroscopical characters.

A. Fruit. B. Seed with testa. C. Seed without testa. D. Cotyledons.

Cotyledons conforming to the interior of the seed and each occupies about a half of it lying transversely to the basal placenta with their very much thickened edges towards it and their thin indented edges to the apex of the endocarp, which is also indented and always much compressed causing the cotyledons to be more or less asymmetrical; radicle at one end of embryo, testa obtuse, curved round the basal end of the cotyledons and pointing upwards.

Microscopical characters (Plate II-IV):

Fruit: (Plate II, Figs. 1-4).

The longitudinal section of the pericarp of the fruit reveals three zones, *viz.*, epicarp, mesocarp and endocarp. The epicarp consists of single layer of epidermis surrounded by a thick cuticle, measuring about 5 μ thick. The epidermal cells are columnar to squarish in shape, thick-walled and lignified. Some of these cells elongate to form trichomes, which are non-glandular, long, uniseriate, uni- to bi-celled, lignified with pointed tapering ends with their walls heavily thickened. They measure $72.5\text{-}125\,\mu \times 12.5\text{-}15.0\,\mu$

In surface view, the epidermal cells appear polyhedral in shape, thickwalled and filled with brownish contents. Glands lined with 7-8 cells are present (Plate II, Fig. 2A).

Next to the epidermis is a wide zone of parenchyma, which constitute the mesocarp region. It is a broad zone distinguished into an outer and inner region, composed mostly of parenchymatous cells having schizo-lysigenous cavities and fibro-vascular bundles. The cells are more or less circular or tangentially elongated with prominent intercellular spaces. Most of the cells are filled with dark brownish contents, but these contents are more abundant in the first 5-6 layers forming a continuous band. Rosette crystals of calcium oxalate are present. Numerous schizogenous or schizo-lysigenous cavities are present, which is a characteristic feature of the family Anacardiaceae. These cavities are of varying sizes, large, mostly elliptical, sometimes circular in shape and are filled with an acrid and yellowish-brown secretion, which is oily in nature. This substance is highly vasicant and turns black on exposure to the air (Gathercoal and Wirth, 1936; Greenish, 1933).

The schizogenous cavities are lined with epithelial cells and are formed due to the dissolution of cells. During the developmental period, some of the parenchymatous cells get dissolved and form lysigenous cavities, which increase in size as the fruits mature.

The fibro-vascular bundles which consist of spirally or reticulately thickened vessels and fibres are irregularly distributed in the mesocarp region (Plate II, Figs. 1, 4).

The endocarp enclosing the seeds consists of obliquely oriented layers of elongated sclereids. It is differentiated into two types of sclerenchyma differing from each other in cell shape and orientation. One type of cells are elongated at right angles to the fruit axis and filled with granular contents. The other type are elongated, parallel to the axis. These cells vary in shape and size, heavily thickened with radiating canals, irregular in shape, with tapering pointed ends. The isolated elements show great variation in shape and size. Some are three armed or four armed, each arm being heavily thickened with a narrow lumen and their ends pointed or chisel like or bifurcated. Sometimes projections appear from the lateral walls (Plate II, Fig. 2 D).

Seed (Plates III & IV):

Structure of the testa (Plate III, Figs. 2-6):

Epidermis consists of polygonal cells with scattered, large, pitted, thickwalled sclerenchymatous cells occurring mostly in groups. The thickening is on all sides. Beneath the epidermis is a small amount of remnants of disorganized and collapsed cells of

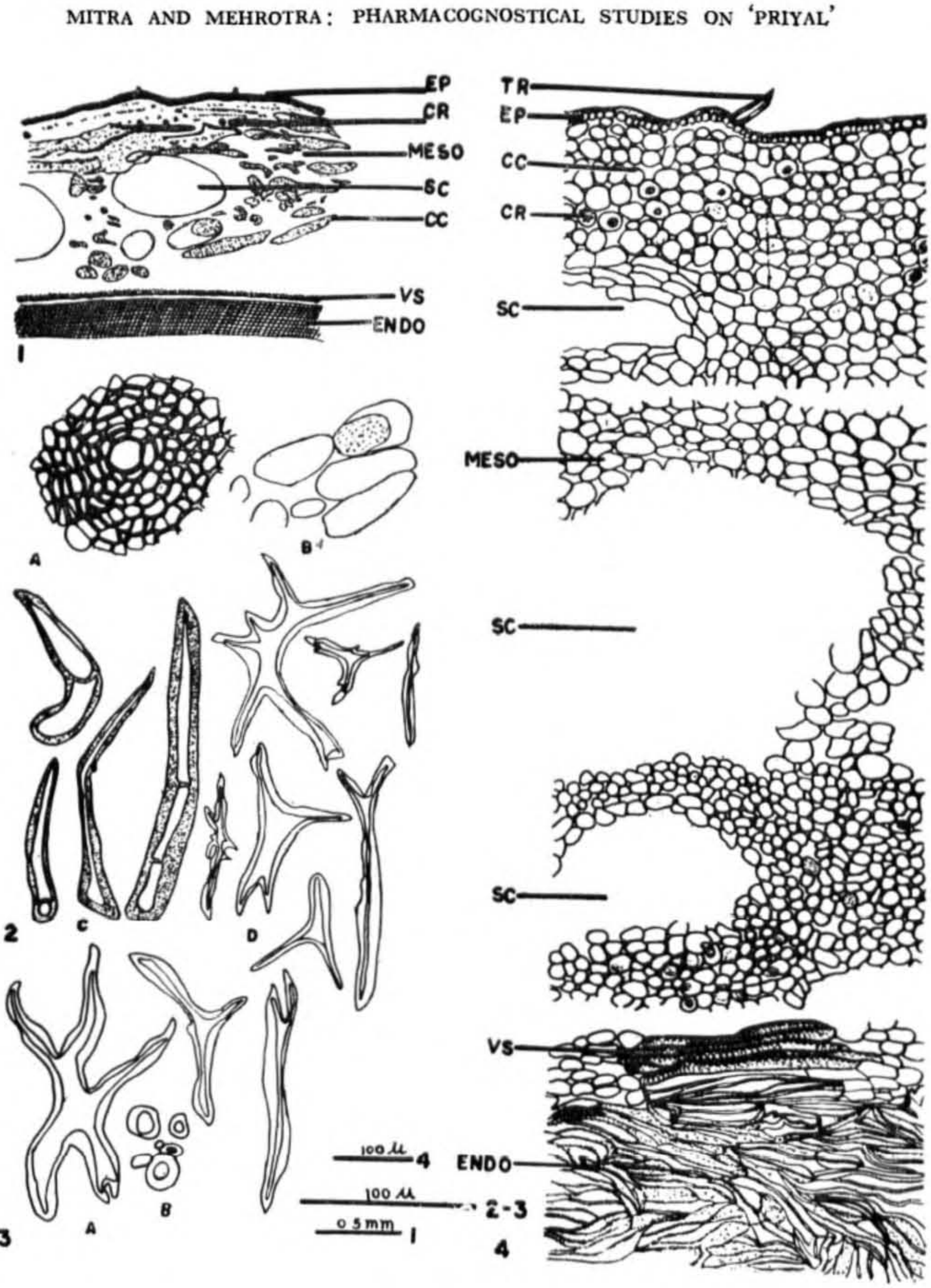

Plate II : Microscopical characters of the fruit of *Buchanania lanzan* Spreng.

Fig. 1 : Diagrammatic representation of the longitudinal section of the pericarp of the fruit. Figs. 2A-D: Powder of the fruit showing microscopical characters. A. Epicarp in surface view. B. Mesocarp parenchyma. C. Trichomes. D. Sclereids of endocarp. Figs. 3A-B : Powder of the market sample of 'Priyal' showing sclereids of endocarp and parenchyma cells filled with contents. Fig. 4 : Longitudinal section of the part of pericarp showing details.

CC = cell contents. CR = crystal. ENDO = endocarp. EP = epicarp. MESO = mesocarp. SC = secretory cavity. TR = trichome. VS = vascular supply.

the integument. These cells are of various sizes, thin-walled and parenchymatous. This layer consists usually of several layers of thin-walled parenchyma, the cells of which are filled with starch in the early stages of development of the seed. As the thickenings of the various parts of the testa are laid down, the starch is gradually used up and the thin-walled cells eventually collapse, forming a band of flattened cells. There are a few layers of parenchyma which are not much collapsed and the outlines of which are readily made out. Some of these cells are filled with brownish con-

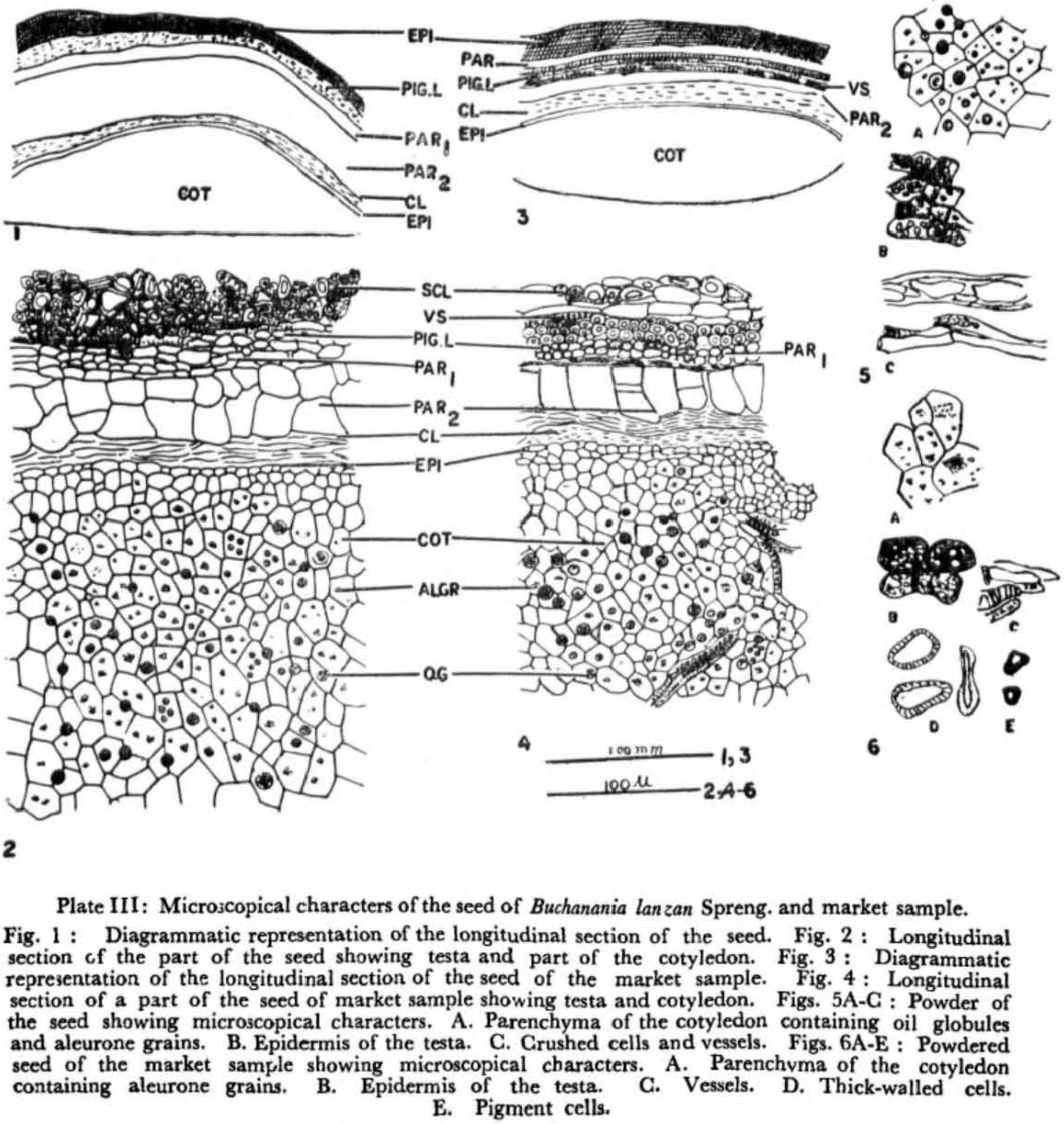

Plate III: Microscopical characters of the seed of *Buchanania lanzan* Spreng. and market sample.

Fig. 1 : Diagrammatic representation of the longitudinal section of the seed. Fig. 2 : Longitudinal section of the part of the seed showing testa and part of the cotyledon. Fig. 3 : Diagrammatic representation of the longitudinal section of the seed of the market sample. Fig. 4 : Longitudinal section of a part of the seed of market sample showing testa and cotyledon. Figs. 5A-C : Powder of the seed showing microscopical characters. A. Parenchyma of the cotyledon containing oil globules and aleurone grains. B. Epidermis of the testa. C. Crushed cells and vessels. Figs. 6A-E : Powdered seed of the market sample showing microscopical characters. A. Parenchyma of the cotyledon containing aleurone grains. B. Epidermis of the testa. C. Vessels. D. Thick-walled cells. E. Pigment cells.

ALGR = aleurone grains. CL = crushed layer. COT = cotyledon. EPI = epidermis. OG = oil globules. PAR_1 = parenchyma. PAR_2 = elongated parenchyma. PIG·L = pigment layer. SCL = sclerenchyma. VS = vascular supply.

tents and form a pigment layer. Next to this layer is a band of parenchyma, which consists of elongated or tubular cells.

Cotyledons (Plate IV, Figs. 1-6):

Closely adhering to the testa are cotyledons, which consist of epidermis and thin-walled parenchyma. The epidermal cells are barrel-shaped, the parenchyma cells are polyhedral and are all filled with aleurone grains of globoid type. The cells of the cotyledons are not very distinctly marked into palisade and spongy layers. The aleurone grains vary in sizes and measure 2.5-5.0 μ in diameter.

Distributed among these parenchyma cells are the procambium bundles running longitudinally. The bundles are mostly confined to the raphe and antiraphe region.

L. S. of cotyledon passing through raphe region shows parenchyma of different sizes, the cells are comparatively smaller in the apical region. L. S. of cotyledon passing through the antiraphe region also shows similar structure except that the vascular strands are more in number, run zigzag way throughout the tissue forming a network and the parenchymatous cells in the centre are more elongated. The plumule and radicle are usually of small meristematic cells.

Cell contents:

The parenchymatous cells of the mesocarp are filled with dark brownish contents and tannin. The oil is present in the secretory cavities as well as in the seed. Abundant aleurone grains and starch are present in the cotyledons. Oil globules are present in the testa. Rosette crystals of calcium oxalate are present in the mesocarp region.

Study of the Powder:

Fruit: The powder is brownish in colour, rough in texture. Microscopically it shows long glandular trichomes, which are thickwalled, uni-bi-cellular, fragments of vessels and fibres, parenchyma filled with brownish contents or devoid of any contents, epidermal cells with glands, crystals of calcium oxalate (rosette) and numerous sclereids of varying shape and sizes (Plate II, Figs. 3 A-B).

Seed: Powdered seed is slightly creamish white mixed with pinkish colour, taste sweet, odour pleasant, oily and sticky in touch. Microscopically it shows parenchyma, numerous aleurone grains, fragments of fibro-vascular elements and oil globules and fragments of sclerenchyma (Plate III, Figs. 5 A-C).

Market Samples:

Market samples of Priyal or Chironji were procured from different parts of the country, *viz.*, Lucknow, Varanashi, Bombay and Calcutta. The samples obtained from the market in the name of 'Chironji' or 'Charoli' consisted of the seeds and broken part of the endocarp. The endocarp is brownish in colour, hard leathery when soaked. Microscopical examination of the endocarp shows sclereids of different size and shape and a few parenchyma cells, which are filled with brownish contents.

The seeds are compressed laterally covered with a thin brown testa marked on both sides by the branching chalaza. Slight pressure separates the oily cotyledons, which are pale yellow in colour. Microscopically the testa shows thickwalled, sclerenchymatous epidermis, 2-3 layers of parenchyma, followed by thick-walled cells and a pigment layer. Beneath this layer lies 1-2 celled, elongated thin-walled parenchymatous layer which is followed by collapsed layer. Cotyledon consists of single layer of epidermis and thin-walled parenchyma in which vascular supply can be observed. Oil globules and aleurone grains are abundantly present.

L. S. of cotyledon passing through raphe and antiraphe region shows the similar structure as that of genuine sample except that the parenchyma cells are larger in the

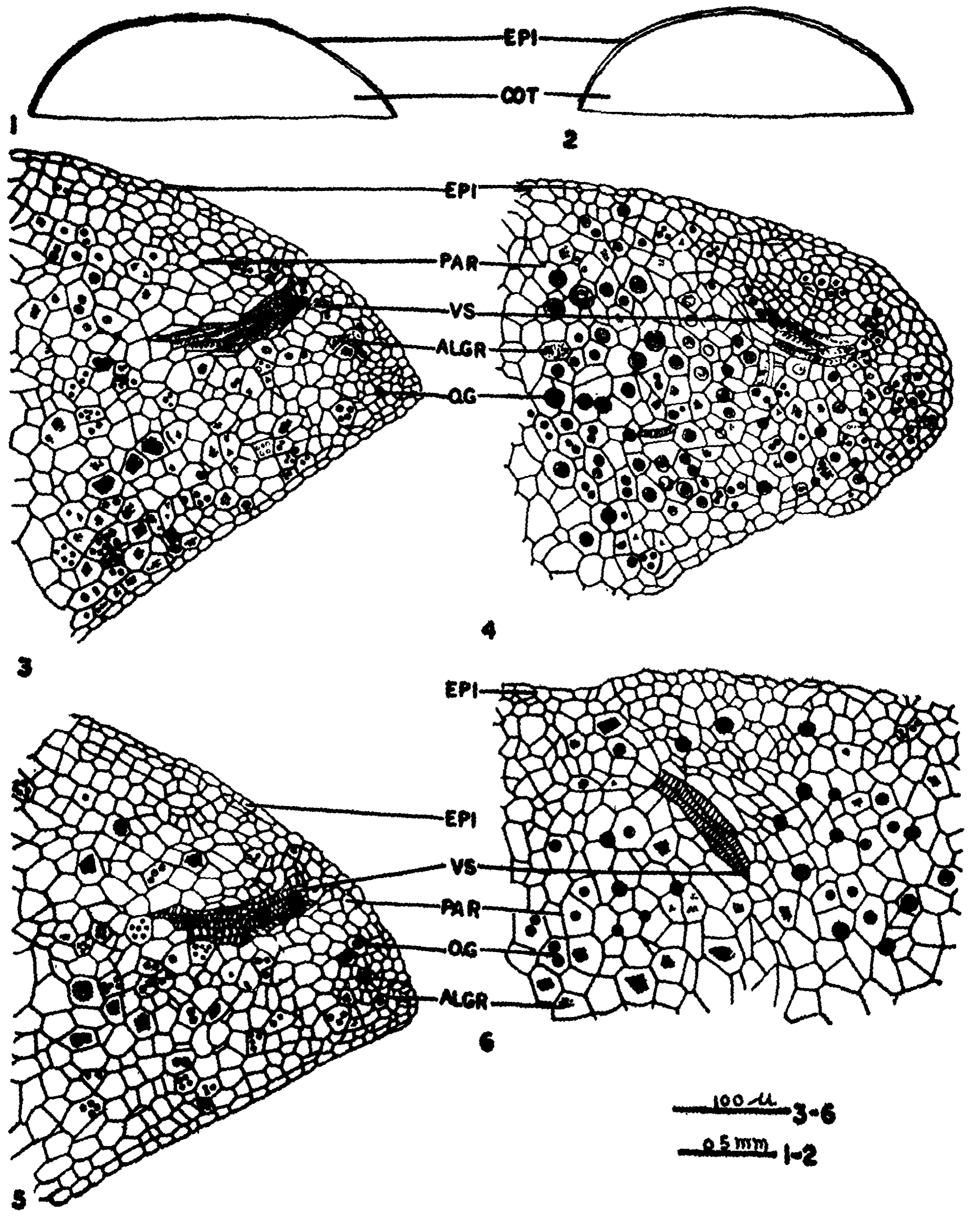

Plate IV : Microscopical characters of the cotyledons of *Buchanania lanzan* Spreng. and market sample. Fig. 1 : Diagrammatic representation of the longitudinal section of the cotyledon. Fig. 2 : Diagrammatic representation of the longitudinal section of the cotyledon of the market sample. Figs. 3 & 4 : Longitudinal section passing through raphe and antiraphe regions showing details. Figs. 5 & 6 : Longitudinal section of the cotyledon of market sample passing through raphe and antiraphe regions showing details.

ALGR=aleurone grains. COT=cotyledon. EPI=epidermis. OG=oil globule.
PAR=parenchyma. VS=vascular supply.

market samples which may possibly due to ecotypic variation. Thick-walled cells in the testa are also observed in the market samples.

DISCUSSION

From the foregoing description of the genuine *Buchanania lanzan* Spreng. as well as the market sample of 'Chironji' derived that though both the samples have many similar characters yet they differ remarkably in dimensions of parenchymatous cells in the cotyledon region; besides, the testa in market sample possesses thick-walled parenchymatous layer above the pigment layer which is absent in genuine samples. Apart from these the percentage of oil and protein percentage are quite different in both. This indicates that the market sample may at least be a different variety of *Buchanania lanzan* Spreng. or if not altogether a different species. There is a possibility of ecotypic variation in *Buchanania lanzan* Spreng. also. Study of other species of *Buchanania* may yield confirmatory evidence.

TABLE 1

Measurement of the Individual cells and tissues of *Buchanania lanzan* Spreng. fruit and seed(in Microns)

FRUIT	
Trichomes	72.5-100-125 × 12.5-15.0
Secretory cavity	100-250-350-500 × 50-200-250-300
Mesocarp parenchyma	20.0-33.5-37.5-50 × 15.0-20.0-30.0-37.5
Endocarp	117-139-200-216 × 17-22-28-31
COTYLEDON	
Aleurone grain	2.5-5 × 2.5-5.0
Epidermis (Scl)	12.5-20.0-25 × 10-12.5-17.5
Parenchyma	37.5-45.0-62.0 × 17.5-25.0-30.0
Inner epidermis	12.5-20.0-25 × 12.5-15.0-20.0
Elongated cells	30.0-50.0-62.5-75.0 × 12.5-15.0-20.0-30.0
Raphe	13-32.5-37.5-45.0 × 8-20-25-32.5
Antiraphe	25-45.0-50.0-62.5 × 12.5-17.5-20.0-30.0
Cells towards the apex (raphe)	10-15.0-20.0-27.5 × 10-15.0-17.5-20.0
Cells towards the apex (anti-raphe)	12.5-15.0-20.0-25 × 7.5-15.0-20.0

TABLE 2

Behaviour of the powedered drug on treatment with different chemical reagents.

Sl. No.	Reagents	Behaviour of the powder
1.	Picric acid (Saturated)	Pale yellow
2.	Lactic acid	No change
3.	Hydrochloric acid (Sp. gr. 1.16)	Light orange
4.	Sulphuric acid (80% soln.)	Red
5.	Iodine solution	Brown with orange tinge
6.	Ferric chloride (5% aq. soln.)	Few cells change brown
7.	Acetic acid	No change
8.	Sudan-III	Red
9.	Powder as such	Creamy

TABLE 3

Fluorescence characters of seed powder of *Buchanania lanzan* Spreng. under u.v. light

Sl. No.	Treatment	Fluorescence
1.	Drug+nitrocellulose in amylacetate	Pale yellow with green tinge
2.	Drug+1N NaOH in methanol	Olive green
3.	Drug+1N NaOH in methanol dried and mounted in nitrocellulose in amyl acetate	Olive green
4.	Drug+1N HCl.	Pale green
5.	Drug+1N HCl, dried and mounted in nitrocellulose in amylacetate	Olive green
6.	Drug+1N NaOH in water	Green
7.	Drug+1N NaOH in water, dried and mounted in nitrocellulose in amyl acetate	Olive green
8.	Drug+1N Nitric acid, diluted in equal volume of water	Yellowish green
9.	Drug+H_2SO_4 diluted with equal volume of water	Green
10.	Drug as such	Pale green

TABLE 4

Physico-chemical constants of *Buchanania* seed oil

Constants	Cultivated sample	Market sample
Percentage of oil	47.23	35.38
Refractive index at 33°C	1.463	1.4625
Moisture percentage	5.629	4.9709
Nitrogen	11.57	10.81
Protein percentage	72.3125	67.5625
Colour of the oil	R 2.8 Y 2.8 G 0.2	R 0.9 Y 18.3 G 0.6
Sap value	197	180
Acid value	1.76	1.71
Iodine value	54.1	54.6

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